PATENT SPECIFICATION (11) 1 410 615

1 410 615

(21) Application No. 57648/72 (22) Filed 14 Dec. 1972
(31) Convention Application No. 7 145 014 (32) Filed 15 Dec. 1971 in
(33) France (FR)
(44) Complete Specification published 22 Oct. 1975
(51) INT. CL.[2] B61D 23/00
B60R 3/02 //
B61D 23/02
(52) Index at acceptance
B7L 106
B7B 245 273 282

(19)

(54) STEP ARRANGEMENTS FOR PASSENGER-CARRIER VEHICLES

(71) We, SOCIETE NATIONALE DES CHEMINS DE FER FRANCAIS, a French body body corporate of 45 Rue Sainte-Lazare, 75009, Paris, France, SOCIETE GENERALE DE CONSTRUCTIONS ELECTRIQUES ET MECANIQUES ALSTHOM, a French body corporate of 38 Avenue Kleber, Paris 16th, France, and FAIVELEY S.A., a French body corporate of 93 Rue du Dr Bauer, 93400 Saint-Ouen, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to step arrangements for passenger-carrier vehicles, such as rail vehicles, and vehicles incorporating such an arrangement.

The steps in such vehicles generally comprise a limited number of stationary steps arranged at suitable levels, at least partly within a stairway access opening.

In practice the number of steps is limited to two or three, which are arranged at a relatively steep gradient, with the result that such steps are sometimes awkward to use, particularly for old people or passengers laden with luggage.

The main reason that the overall gradients of such steps are relatively steep is that they must fit within a space defined by two vertical planes substantially parallel to the longitudinal axis of the vehicle, one plane being disposed at a position which corresponds to the laterally outermost part of the vehicle and the other plane being disposed within the vehicle at a position determined by the necessity of limiting the area taken up, within the vehicle, by the stairway opening containing the steps.

In order to increase the usefulness of such step arrangements it has already been proposed that they can be provided with a plate designed to form an extra step; the plate is mounted so that it can move between a retracted or waiting position, in which it is within the overall width of the vehicle, and an extended or operative position in which it is available to a passenger attempting to enter the vehicle.

In the extended, operative position, however, the plate projects beyond the overall width limit of the vehicle, so that, if for one reason or another, it should be in the extended position when the vehicle is moving, there is the danger of the plate striking some obstacle close to the track along which the vehicle is travelling, thus causing a mishap or even an accident.

According to the present invention, there is provided a step arrangement for a passenger-carrier vehicle, comprising one or more stationary steps arranged in use at a suitable level or levels, an additional step provided by a plate movable in its own plane relative to the stationary step or steps between a retracted position and an extended position, and two parallel crank means carrying the plate, the crank means being rotatable about respective axes through at least 180° to move the plate, whereby the two crank means, an imaginary line joining respective points at which the crank means are pivotally connected to the plate, and an imaginary line joining the said axes of the crank means define a deformable parallelogram.

In another aspect, for a passenger-carrier vehicle having a body, a floor within the body, an access opening in the body and extending below the level of the floor, the floor having an opening adjacent the access opening in the body to receive a stairway, and a door capable of closing the access opening, the invention further provides a step arrangement according to the immediately preceding paragraph wherein in use said stationary step or steps is or are arranged in the stairway opening, the step arrangement further including a closure

[Price 33p]

BEST AVAILABLE COPY

means movable in use obliquely upwardly and downwardly between an extended position in which it closes said stairway opening in the floor and a retracted position in which it opens said stairway opening.

A step arrangement according to the present invention will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is an elevation of an end part of a rail vehicle equipped with the step arrangement,

Figure 2 is a view of the end part of the vehicle of Figure 1 in cross-section at line II-II,

Figure 3 is a diagrammatic perspective view showing the principle of the step arrangement,

Figures 4 and 5 are views in longitudinal section through a mechanism for actuating the movable plate of the step arrangement, the sections being taken along lines IV-IV and V-V respectively in Figure 6.

Figures 6 and 7 are two views of the mechanism of Figures 4 and 5 in cross-section along lines VI-VI and VII-VII respectively in Figure 5,

Figure 8 is a fragmentary plan view of one of the components of the mechanism, viewed in the direction of arrow VIII in Figure 6,

Figure 9 is a view from below of the movable plate of the step arrangement,

Figures 10 to 12 are views of the movable plate in partial cross-section along lines X-X, XI-XI and XII-XII respectively in Figure 9,

Figure 13 is a vertical cross-sectional view of the step arrangement with associated closure means,

Figures 14 and 15 are views in partial cross-section along lines X1V-X1V and XV-XV respectively in Figure 13,

Figures 16A, 16B and 16C are diagrammatic views illustrating various phases in the operation of the closure means,

Figures 17A, 17B and 17C are diagrammatic plan views illustrating the movement of a movable plate of the step arrangement,

Figures 18, 19 and 20 are block diagrams illustrating the control of the various members of the step arrangement.

Referring to Figures 1 to 3 a passenger-carrier vehicle is shown in the form of a rail passenger vehicle which has at its end a step arrangement which extends within an access opening having a door 15. Starting from the internal platform or floor 14 of the vehicle, the step arrangement comprises two stationary steps 11 and 12 and a movable plate 13, forming steps at appropriate levels. The step arrangement is disposed within an appropriate stairway opening 10 in the floor, and the door extends below the level of the floor.

The stationary steps 11 and 12 are arranged entirely within the vehicle, while the movable plate 13 is outside it. The door 15 may be of the kind which is opened or closed by a combined sliding and pivoting movement.

As shown diagrammatically in Figure 3, the plate 13 is carried by two discs 16 and 17, the plate being pivotally connected to the discs 16 and 17 by respective pivots 33 and 34. The disc 16 is carried on and keyed to a drive shaft 20 which is releasably coupled to a pinion 21 meshing with a rack 22. The rack 22 is reciprocable by any suitable means, such as a pneumatic or hydraulic double-acting jack 23. The disc 17 is similarly rotatably mounted on a support shaft 28. Radial lines interconnecting the shaft 20 and the pivot 33, and the shaft 28 and the pivot 34 respectively thus provide notional crank means which are parallel to each other, for supporting the plate 13. These radial lines, in conjunction with imaginary lines interconnecting pivots 33 and 34, and shafts 20 and 28 respectively, thus define a parallelogram which is deformable by rotation of the discs 16 and 17. Thus, actuation of the rack 22 will cause rotation of the shaft 20 and thus the disc 16. The rotary motion is transmitted to the disc 17 by means of a connecting assembly comprising a first coupling crank 25 which is keyed on the shaft 20 and coupled by a coupling rod 26 to a second coupling crank 27 which in turn is keyed on the shaft 28 carrying the disc 17.

A return spring 29 extending obliquely relative to the rod 26 is connected between the rod 26 and a point 30 which is fixed relative to the vehicle.

These various arrangements will be described in greater detail hereinafter.

Reference will now be made to Figures 4 to 12.

As can best be seen from Figure 9, the plate 13 is carried on the discs 16 and 17 by carrier means in the form e.g. of two arms 31 and 32 which form part of the plate 13 and which are connected by the pivots 33 and 34 to the respective discs 16 and 17; the plate 13 also has a body portion comprising a frame assembly 35 connected to the arms 31 and 32 by fork joints 36 and 37 and shafts 38 and 39 forming a horizontal axis.

The frame 35 receives any suitable filling, for example an expanded metal sheet (not shown).

The arms 31 and 32 extend radially of the corresponding discs 16 and 17 and are extended beyond the discs to carry a respective supporting stop or detent member of adjustable length, for example a respective screw as shown at 40 and 41 in Figures 9 and 10.

The frame 35 of the movable plate 13 also carries an extension 42 which passes between the arms 31 and 32. As can best be seen from Figure 11, the end of the extension 42 carries a projection or boss 43.

At a position in line with the boss 43, a stationary casing 45 which is rigidly connected to the structure of the vehicle and which contains means for actuating the plate 13, as will be described later, carries a fork lug 46 carrying a shaft 48. A lever 47 which can rock against the action of a spring 49 (Figures 9 and 11) is mounted on the shaft 48.

As will subsequently become apparent, one of the ends 50 of the lever 47 can come into co-operation with an engagement means such as a recess or, as shown, a groove 51 provided for this purpose in the frame 35 of the movable plate 13 (Figure 11), while the other end 52 of the lever 47 can interact with the boss 43 carried by the extension 42.

Each disc 16 and 17 carries two radially extending bearing blocks 53 and 54 in diametrically opposed positions, designed to interact with angle members 55 and 56 rigidly connected to the casing 45.

The drive shaft 20 is rotatably mounted in a pillow block 59 which is rigidly connected to the casing 45, with a bearing 60 interposed between the shaft 20 and the block 59.

The pinion 21, which is the member for actuating the shaft 20 (Figures 5 and 6), is disposed coaxially on the shaft 20 and can be coupled to it by disconnectable keying means; these means comprise a cylindrical casing 62 co-axial with the drive shaft 20 and rigidly locked to the pinion 21, and a locking means 63 movably mounted within a member 65 which is keyed to the drive shaft 20 within the casing 62.

As can best be seen from Figure 8, the locking means 63 comprises a sliding block 66 with a roller 67 mounted rotatably at its end; the block 66 is mounted so as to be movable against a spring 68, in a slide guide 69 in the member 65.

The spring 68 urges the locking means 63 towards the cylindrical wall 70 of the casing 62. The wall 70 contains a seating, for example an aperture 71 as shown, in which part of the roller 67 carried by the block 66 can engage.

The member 65 also carries a circular plate or cover 72 which closes the cylindrical casing 62.

The toothed rack 22 with which the pinion 21 meshes is carried by a sliding block 74 movably mounted by dovetailing on a guide 75 and is coupled by a rod 76 to a piston 77 of the jack 23.

The crank 25 shown in Figure 3, which is keyed to the drive shaft 20 of the disc 16, can be provided by the cover 72 of the cylindrical casing 62; in other words, instead of the coupling rod 26 being connected to a crank 25 as in Figure 3, the coupling rod 26 can be link at one end to a pivot 79 rigidly connected to the cover 72 (Figures 4 and 6), while the other end of the rod 26 is linked to a pivot 80 rigidly connected to the crank 27 (Figures 4 and 7).

Figures 4 to 6 show the return spring 29 which is coupled at one end to a shaft forming the above-mentioned fixed point 30, rigidly connected to the casing 45, and at the other end to a pivot 83 rigidly connected to the coupling rod 26.

In Figures 3 to 10 and also Figure 17A, the movable plate 13 is in the retracted, inoperative position. The pivots 33 and 34 carrying the plate are then disposed between an imaginary line joining the shafts 20 and 28 and the longitudinal centre line of the vehicle (not shown).

The rack 22 is then in one of the end positions of its reciprocating movement, corresponding for example to the retracted position of the piston 77 of the jack 23, as shown in Figure 5.

When the jack is actuated, it will cause the pinion 21 to be turned through 180° by means of the rack 22. If the roller 67 carried by the locking means 63 is engaged in the aperture 71 in the casing 62, then the pinion 21 will be secured by the roller 67 to the drive shaft 20 of the disc 16 of the plate 13. Consequently rotation of the pinion 21 through 180° causes the crank disc 16 to turn through 180°, and the disc 17 is similarly rotated by virtue of the connecting rod and cranks which link the shafts 20 and 28.

The movable plate 13 passes from its retracted inoperative position, shown in continuous lines in Figures 3 and 17A, to an extended operative position shown in broken lines in Figure 3 and continuous lines in Figure 17C, via a continuous succession of laterally off-set intermediate positions, of which one is shown in broken lines in Figure 3 and continuous lines in Figure 17B.

As mentioned above an imaginery line interconnecting pivots 33 and 34, together with the crank means formed by the discs 16 and 17, constitute three sides of a parallelogram whose fourth side is defined by the imaginery line joining the shafts 20 and 28 (Figure 3) and which can be deformed about the shafts of the discs. This parallelogram is shown diagrammatically by broken lines 90 in Figures 17A, 17B and 17C.

If either of the transverse end surfaces 91 and 92 of the plate 13 or the longitudinal surface 93 thereof should make impact with an obstacle, the movement whereby the

plate 13 is being extended is stopped. This causes the roller 67 to be withdrawn into the member 65 against the spring 68, which results in the cylindrical casing 62 becoming released from the member 65 and causes the drive shaft 20 of the crank disc 16 to become released from the associated pinion 21.

The roller 67 is then free to roll over the cylindrical wall 70 of the casing 62, and the drive shaft 20 of the disc 16 is also free to turn.

Consequently the return spring 29, the tension in which is increased as the plate 13 is moved towards its extended position, returns the plate forcefully to its retracted, inoperative position.

The fact that the return spring 29 is arranged obliquely relative to the coupling rod 26 means that there is no danger of the plate 13 interfering with or jamming the restoring action of the spring.

If a control order for returning the plate to its retracted position is given while the plate is in the extended position, it will come back to its initial position in a movement which forms a continuation of the extending movement, with the crank discs 16 and 17 turning through a total of 360°.

If on the other hand the automatic order for the return movement intervenes before the plate 13 has reached its extended, operative position, then the return movement will be the reverse of the extending movement.

Moreover when the plate has reached its extended operative position, if a heavy load is exerted on it, for example of the order of 30 kg, due for instance to a person standing on the step, then the boss 43 on the extension 42 of the plate 13 acts on the end 52 of the lever 47, purely by virtue of the resilience of the materials acted on by the load in question, with the result that the other end 50 of the lever 47 engages in the groove 51 formed in the part 35 (Figure 11). This co-operation of the lever 47 and the groove 51 will thus prevent the plate from being displaced from its extended towards its retracted position, while a load such as a person is on the plate.

From then on, even if the rack 22 is actuated to cause the plate 13 to be moved towards the retracted position, the roller 67 will again escape from the casing 62, so that the plate 13 will remain in the extended position despite the displacement of the rack 22.

As soon as the load ceases to be exerted on the plate, the plate 13 will be returned resiliently to its retracted position by the spring 29, as before.

The rocking lever 47 thus constitutes a locking member which can be overridden but which can counteract any untimely actuation of the plate 13 when a user has set foot on it.

The end 50 of the lever 47 is shaped so as to ensure that the lever 47 comes out of engagement with the groove 51, when the boss 43 ceases to act on the lever 47.

Finally, when a user sets foot on the plate 13, whether the latter is in the retracted or extended position, one of the blocks 53 and 54 carried by the crank discs 16 and 17 will be adjacent the associated stationary angle member 55 and 56. In this way, by the resilience of the materials used, the blocks 53 and 54 come to bear against the associated angle members 55 and 56, thereby relieving the forces loading the components involved.

With the same end in view, the screws 40 and 41 carried by the arms 31 and 32 of the plate 13 come to bear against the ends of the shafts 20 and 28 of the corresponding crank discs 16 and 17 when the plate 13 is in the extended position.

In the step arrangement described above the stationary steps 11 and 12 are arranged at a gradient which is more gentle than the gradient usually found in such cases, the gradient being measured relative to the horizontal. As an indication, it can be stated in this connection that the average gradient of the steps as described above can attain 45°. This means that the stairway access opening 10 within which the steps open out will encroach on a relatively large area of the platform or floor 14 of the vehicle.

In order to prevent the stairway access opening 10 from being inconvenient or even dangerous to users moving around in the vehicle when the latter is travelling, associated with the access stairway opening 10 is a closure means 100 movable from an extended position, in which it is at the level of the floor 14 of the vehicle and in conjunction with the door 15, closes the stairway acces opening 10, to a retracted position in which it forms part of the steps.

As illustrated in Figure 13, the closure means 100 comprises two plates, a plate 101 and a plate 102 which is hinged to the plate 101 about a horizontal axis.

The profiles of the interconnected limbs of the plates 101 and 102 are made in such a way that, when the plate 102 is subjected only to its own weight, it forms a continuation of the plate 101 and bears against the latter, as shown in continuous lines in Figure 3 and broken lines in Figure 13.

The plate 102 is associated with stationary guides 104 carried by the underframe of the vehicle, slightly below the floor 14 of the latter; the function of the stationary guides 104 will become apparent at a later stage.

The plate 101 is carried on a shaft 105.

which extends obliquely relative to the plate 101, in a guide sleeve 106, protected by a cover 107.

In the embodiment illustrated the shaft 105, which extends obliquely re Vfor 105 is tubular and is of generally rectangular cross-section. The same applies to the guide sleeve 106.

As illustrated in Figures 13 to 15, the guide sleeve 106 carries rotatable rollers 110 near each end. These rollers cooperate with rounded corner portions of the cross-section of the shaft 105 to guide the latter.

An actuating means, for example the piston 112 of a double-acting jack 113 as shown diagrammatically in Figure 14, is also fixed to the plate 101 of the closure means 100.

The jack 113 extends parallel to the tubular shaft 105, as does a return spring 115 arranged at the other side of the guide sleeve 106 from the jack 113, for returning the closure means 100 to the Figure 13 position.

In the extended position (Figure 16A) the jack 113 holds the closure means 100 in a position in which it is level with the floor 14 of the vehicle, against the force of the return spring 115.

When the order is given for actuation of the jack 113, to retract the closure means 100, the jack 113 causes a movement of the closure means 100 generally downwardly within the stairway access opening 10.

As the jack 113 extends obliquely relative to the plate 101 the movement of the closure means 100 within the stairway access opening 10 is obliquely downwards, so that its plate 102 is brought into contact with the stationary guides 104.

From then on the plate 102 is gradually pivoted relative to the plate 101 (Figure 16B) towards a vertical position and this movement is continued until (Figure 16C) the closure means has reached its retracted position, in which the plate 101 is placed against the first stationary step 11 and the plate 102 rises substantially perpendicularly from the stationary step.

It is then possible to gain access to the steps in order to enter or leave the vehicle.

Arrangements are preferably adopted for combined, controlled movement of the movable plate 13, the closure means 100 and the associated access door 15.

Safety measures are preferably also adopted to avoid any untimely operation of these components when the vehicle is travelling above a given speed.

Assuming, for example, that the vehicle is travelling at normal speed and that, in anticipation of an impending stop, any passanger presses a button or any operating means provided to open the door 15, so long as the speed of the vehicle is above a given limit, for example of the order of 25 kph, actuating the operating means will have no effect.

When the vehicle has slowed down to a speed between 25 and 10 kph for example, the opening request made by the passenger is recorded and indicated as such by a tell-tale lamp.

If the speed of the vehicle increases again to above 25 kph, the request will be cancelled and the tell-tale lamp will go out.

If on the other hand the speed of the vehcile continues to drop to below 10 kph, the closure means 100 starts moving slowly downwardly (Figure 16B) and the door 15 is unbolted as soon as the speed is below 5 kph. As soon as the speed of the vehicle is below 2 kph, the door 15 opens and the movable plate 13 is extended as described above (Figure 16C).

A similar sequence takes place automatically when an order for such opening is given with the vehicle stationary, either from inside or outside the vehicle.

Similar arrangements are preferably adopted for closing.

The closing of all the doors in one carriage or even the closing of all the doors in a homogeneous train consisting entirely of such carriages may be remote controlled. The doors may also be closed individually.

If however the vehicle starts moving without any order having been given for the doors to be closed, the movable plate 13 will automatically start its retracting movement as soon as the speed of the vehicle reaches 2 kph, provided that a sufficient load, for example due to a passenger, is not still applied to the plate 13, as described above; then the door 15 is closed automatically when the speed of the vehicle reaches 5 kph. The closure means moves automatically into the extended position (Figure 16A) as soon as the speed of the vehicle reaches 10 kph.

The closure means 100 in all cases will move slowly enough to avoid taking by surprise any person who might be standing on it.

These various possibilities are illustrated by the block diagrams of Figures 18, 19 and 20.

In these diagrams, 120 represents the actuating means for the movable plate 13, 121 the actuating means for the closure means 100, 122 the actuating means for the associated door 15, and 123 the actuating means responsible for unbolting the door; these various actuating means 120-123 are preferably double-acting pneumatic rams, fed in parallel from a common source of compressed air 125, although their actuation is controlled by a group of relays 126 having an electricity supply source 127.

The group of relays 126 is actuated by a speed analyser or detector means 128 and by an internal push-button 129 for closing (Figure 18), an internal push-button 130 for opening (Figure 19) and an external push-button 131 for opening (Figure 20).

The speed analyser or detector 128 is responsive to the speed of the vehicle. It may be controlled by a pulse generator 132 controlled by an acoustic wheel 133 rigidly locked in rotation to any wheel of the vehicle.

The speed analyser or detector 128 has a plurality of outputs each corresponding to a given speed of the vehicle.

With reference for example to the automatic closing of a door (Figure 18) there is an output S1 which is operative at a speed of over 2 kph, an output S2 operative at a speed of over 5 kph and an output S3 which is operative at a speed of over 10 kph.

Acting through the group of relays 126, the output S1 directly controls the actuating means 120 of the movable plate 13, the output S2 directly controls the actuating means 122 of the door 15, and the output S3 directly controls the actuating means 121 of the closure means 100; the means 123 is not actuated so that the door is bolted shut.

The push button 129 and a remote control unit 135 which may be provided may also act on the actuating means 120-122 via a group of relays 126 but independently of the speed of the vehicle.

The remote control unit 135 may have as many outputs as there are doors to control.

Referring now to the opening of such a door from inside the vehicle (Figure 19), the speed analyser or detector 128 has three outputs S'_1, S'_2, S'_3.

The output S'_1 is operative only if the speed of the vehicle is less than 10 kph, the output S'_2 only if it is less than 5 kph and the output S'_3 only if it is less than 2 kph.

The push button 130 is itself also controlled by the speed analyser 128 which, through an output S'_4, prevents actuation thereof if the speed of the vehicle is over 25 kph.

Below this speed of 25 kph, actuation of the push button 130 will set in action the actuating means 121 of the closure means 100 as shown in Figure 19.

Associated with the actuating means 121 is a travel limiting stop 141 which governs the use of the actuating means 123 for unbolting the door 15.

Associated with the actuating means 123 is a travel limiting stop 143 governing the use of the actuating means 120 for the movable plate 13 and of the actuating means 122 for the door 15.

Associated with the actuating means 122 is a travel limiting stop 142 which governs the stopping thereof.

As illustrated in Figure 20, an external push-button 131, provided that it is operated while the speed of the vehicle is still below 25 kph, will permit operation of the actuating means 121 for the closure means 100, operation of the actuating means 123 for unbolting the door 15, and operation of the actuating means 122 for the door 15; this is done directly, as illustrated via the group of relays 126 and thus independently of the speed.

As before, opening of the door 15 is governed by the travel limiting stop 143 associated with the actuating means 123, and the actuating means 122 for the door is stopped by the associated travel limiting stop 142.

As for the plate 13, this comes out automatically as soon as the speed of the vehicle drops below 2 kph.

As indicated in Figure 20, a service opening cut-out or switch means 150 may be arranged in parallel with the external opening push-button 131, the cut-out 150 possibly being operable to actuate an acoustic signal means 151.

Various modifications can be made without departing from the scope of the invention as defined by the appended claims.

WHAT WE CLAIM IS:

1. A step arrangement for a passenger-carrier vehicle, comprising one or more stationary steps arranged in use at a suitable level or levels, an additional step provided by a plate movable in its own plane relative to the stationary step or steps between a retracted position and an extended position, and two parallel crank means carrying the plate, the crank means being rotatable about respective axes through at least 180° to move the plate, whereby the two crank means, an imaginary line joining respective points at which the crank means are pivotally connected to the plate, and an imaginary line joining the said axes of the crank means define a deformable parallelogram.

2. A step arrangement according to claim 1 wherein said crank means are rotatable through 360°.

3. A step arrangement according to claim 1 or claim 2 wherein one of said crank means is a drive crank and is secured to a drive shaft which is releasably connectable to an actuating means by releasable keying means.

4. A step arrangement according to claim 3 wherein said actuating means comprises a pinion which is co-axial with said drive shaft and which meshes with a reciprocable toothed rack.

5. A step arrangement according to claim 4 wherein said rack is reciprocable by a

double-acting jack.

6. A step arrangement according to claim 3, claim 4 or claim 5 wherein said keying means comprises a cylindrical casing which is co-axial with said drive shaft and which is coupled to the actuating means, the cylindrical wall of the said casing containing a seating such as an aperture, and a locking means which is movably mounted within a member secured to said drive shaft within said casing and which is urged resiliently towards said cylindrical wall of said casing, to co-operate with said seating.

7. A step arrangement according to claim 6 wherein said locking means comprises a slide block slidably carried by said member secured to the drive shaft, a roller mounted rotatably in the slide block, and a spring urging the slide block towards said cylindrical wall.

8. A step arrangement according to any one of the preceding claims wherein the two crank means are coupled together by a connecting assembly comprising a coupling rod and two coupling cranks.

9. A step arrangement according to any one of the preceding claims, including means for automatically returning the plate towards said retracted position.

10. A step arrangement according to claim 9 when appendant to claim 8 wherein said returning means comprises a spring connected between the coupling rod and a point which is fixed relative to said stationary step or steps.

11. A step arrangement according to claim 10 wherein the spring forming said returning means extends obliquely relative to said coupling rod.

12. A step arrangement according to any one of the preceding claims wherein at least one of the crank means carrying the plate is provided by a disc.

13. A step arrangement according to any one of the preceding claims wherein supporting stops are operatively associated with the movable plate, at least in its extended position.

14. A step arrangement according to claim 13 wherein said supporting stops comprise, for at least one of the crank means, a detent member carried by the movable plate and capable of bearing against the shaft of said at least one crank means when said plate is in its extended position.

15. A step arrangement according to claim 14 wherein said detent member is adjustable in length.

16. A step arrangement according to claim 15 wherein said detent member is a screw.

17. A step arrangement according to any one of claims 13 to 16 when appendant to claim 12 wherein the supporting stops comprise blocks which are carried by and extend radially of the or each disc forming the or each respective crank means, which blocks can interact with angle members which are fixed with respect to the axes of rotation of the crank means.

18. A step arrangement according to any one of the preceding claims including a locking member operatively associated with the movable plate such that the locking member is operable to lock said plate in its extended position when a load is supported on said plate.

19. A step arrangement according to claim 16 wherein said locking member comprises a lever pivotal against the action of resilient means, one end portion of the lever being co-operable with an engagement means such as a recess or groove in the movable plate, and a projection being carried on said plate at a spacing from said engagement means and being capable of acting on the other end portion of said lever.

20. A step arrangement according to any one of the preceding claims wherein the movable plate comprises carrier means connected to the crank means, and a body portion connected to the carrier means pivotally about a horizontal axis.

21. For a passenger-carrier vehicle having a body, a floor within the body, an access opening in the body and extending below the level of the floor, the floor having an opening adjacent the access opening in the body to receive a stairway, and a door capable of closing the access opening, a step arrangement according to any one of the preceding claims wherein in use said stationary step or steps is or are arranged in the stairway opening, the step arrangement further including a closure means movable in use obliquely upwardly and downwardly between an extended position in which it closes said stairway opening in the floor and a retracted position in which it opens said stairway opening.

22. A step arrangement according to claim 21 wherein the closure means comprises a first plate member which in the retracted position of the closure means rests against the stationary step or against the uppermost of a plurality of said stationary steps, and a second plate member connected to the first plate member pivotally between an extended position in which it forms a continuation of the first plate and a retracted position in which it is substantially perpendicular thereto.

23. A step arrangement according to claim 22 including stationary guide means for guiding the movement of the second plate member between the extended and the retracted positions.

24. A step arrangement according to any one of claims 21 to 23 including. in

operative association with said closure means, an actuating means such as a double acting jack and/or a return member for returning the closure means towards its retracted position.

25. A step arrangement according to any one of claims 22 to 23 wherein the first plate member of the closure means is carried by an obliquely extending shaft slidable in a guide sleeve.

26. A step arrangement according to claim 25 wherein said shaft is tubular.

27. A step arrangement according to claim 25 or claim 26 wherein rotatable rollers are interposed between the shaft and the guide sleeve.

28. A step arrangement substantially as hereinbefore described with reference to the accompanying drawings.

29. A vehicle including a step arrangement according to any one of the preceding claims.

For the Applicants,
D. YOUNG & Co.,
Chartered Patent Agents,
9 & 10 Staple Inn,
London WC1V 7RD.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1975.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1 410 615 COMPLETE SPECIFICATION
8 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

FIG.1

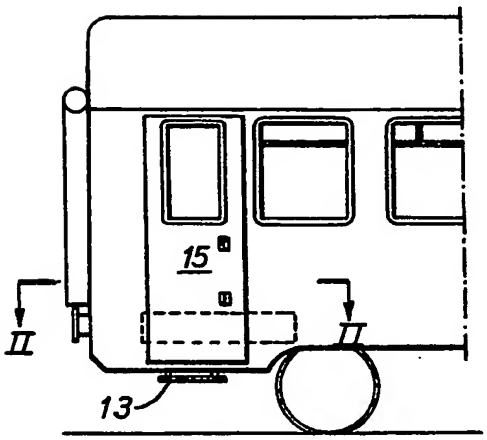


FIG.2

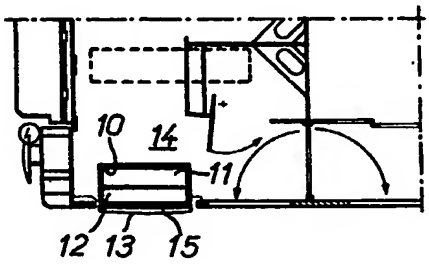
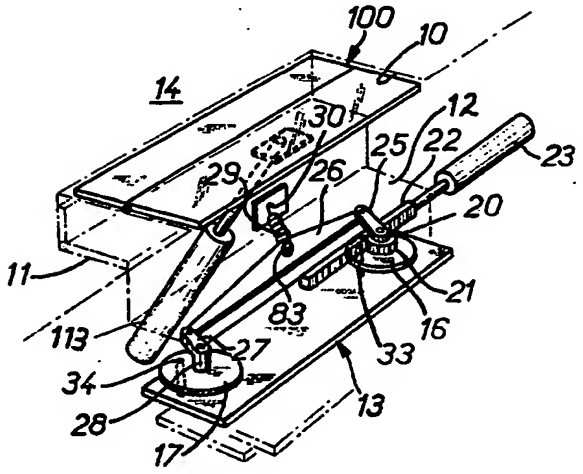


FIG.3



1 410 615
8 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

SHEET 2

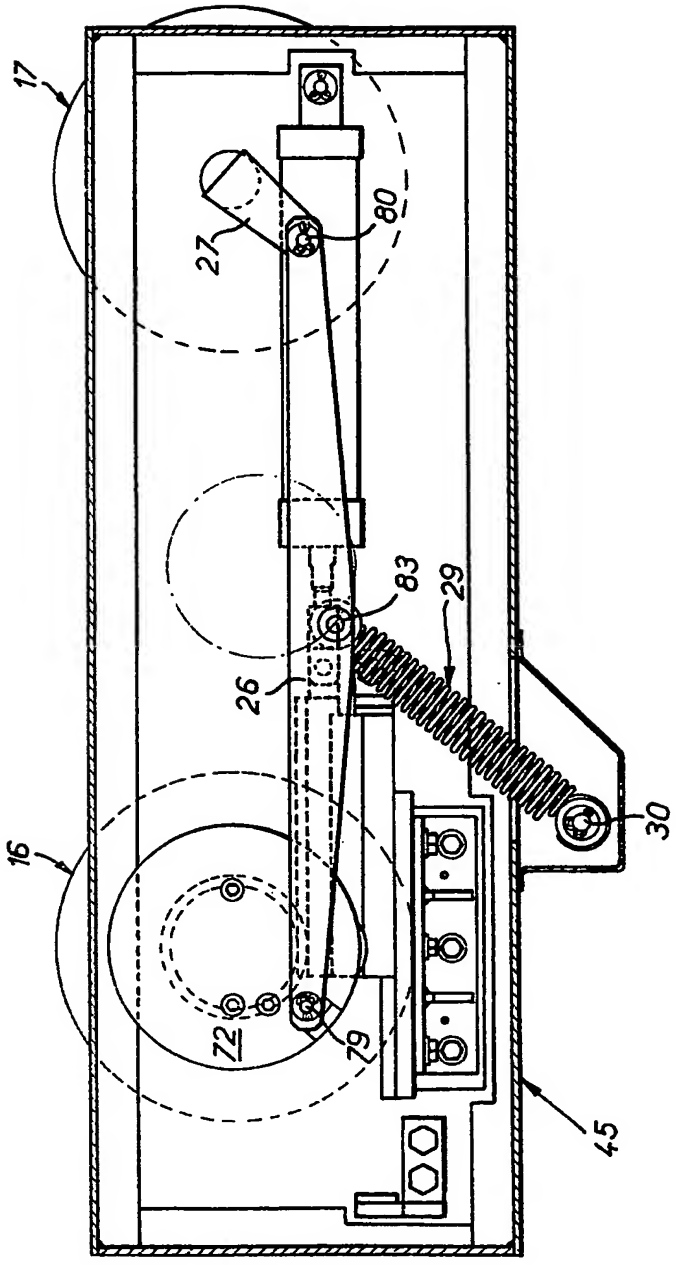
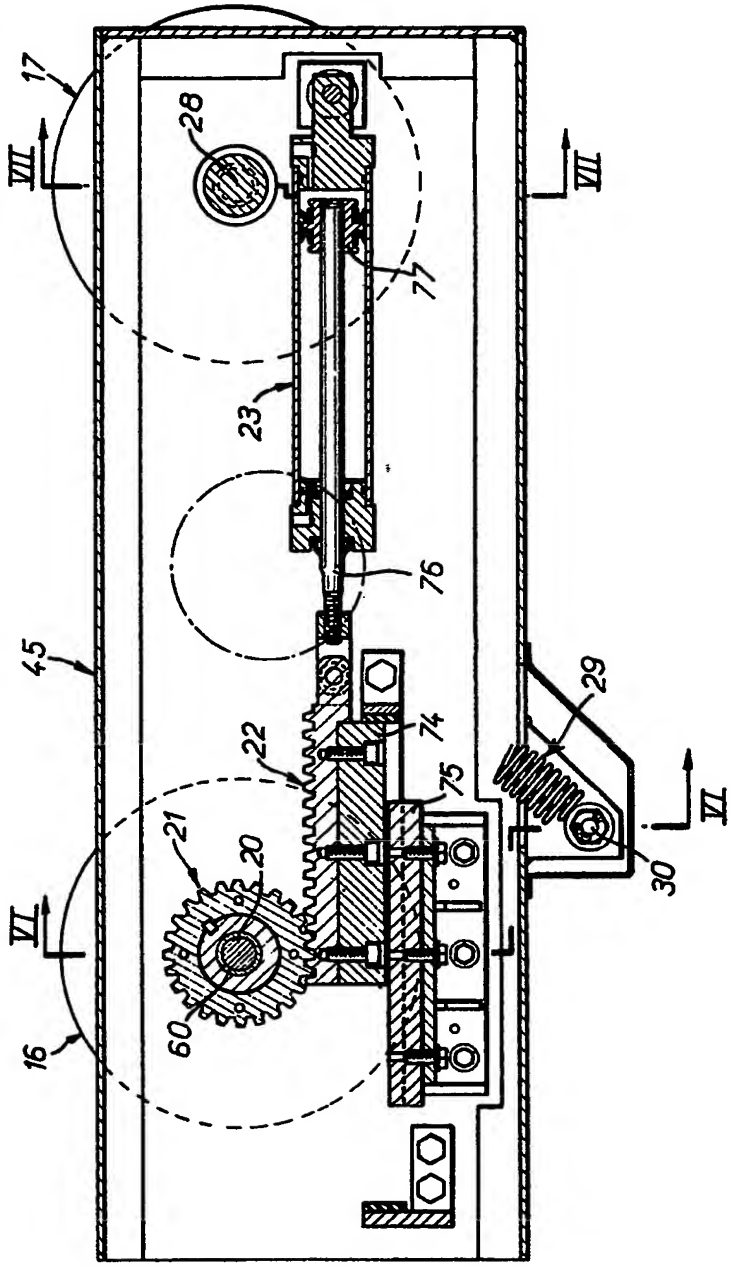


FIG. 4

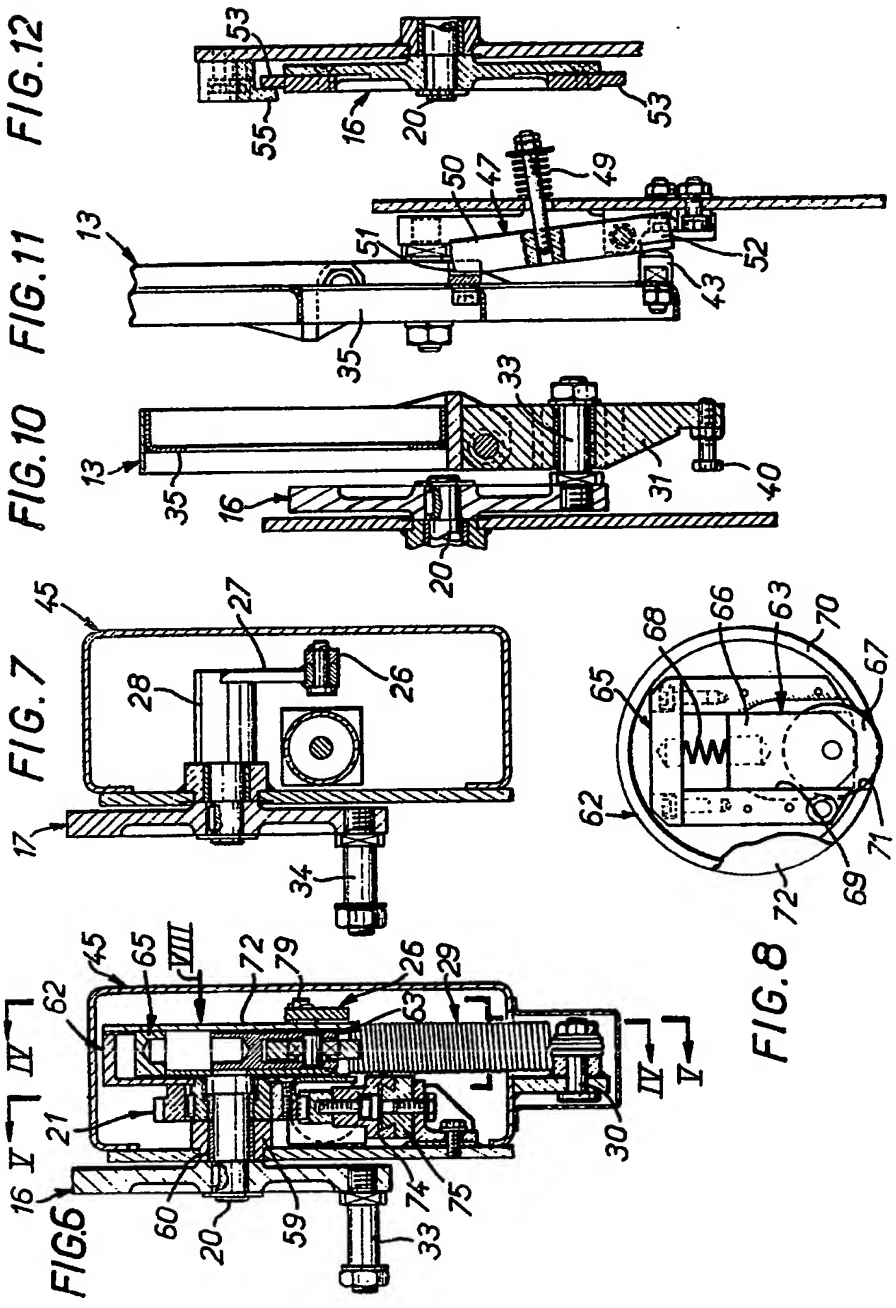
1410 615 COMPLETE SPECIFICATION
8 SHEETS
This drawing is a reproduction of the Original on a reduced scale.

FIG.5



1 410 615 COMPLETE SPECIFICATION
8 SHEETS

This drawing is a reproduction of the Original on a reduced scale.



1 410 615 COMPLETE SPECIFICATION
8 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 5

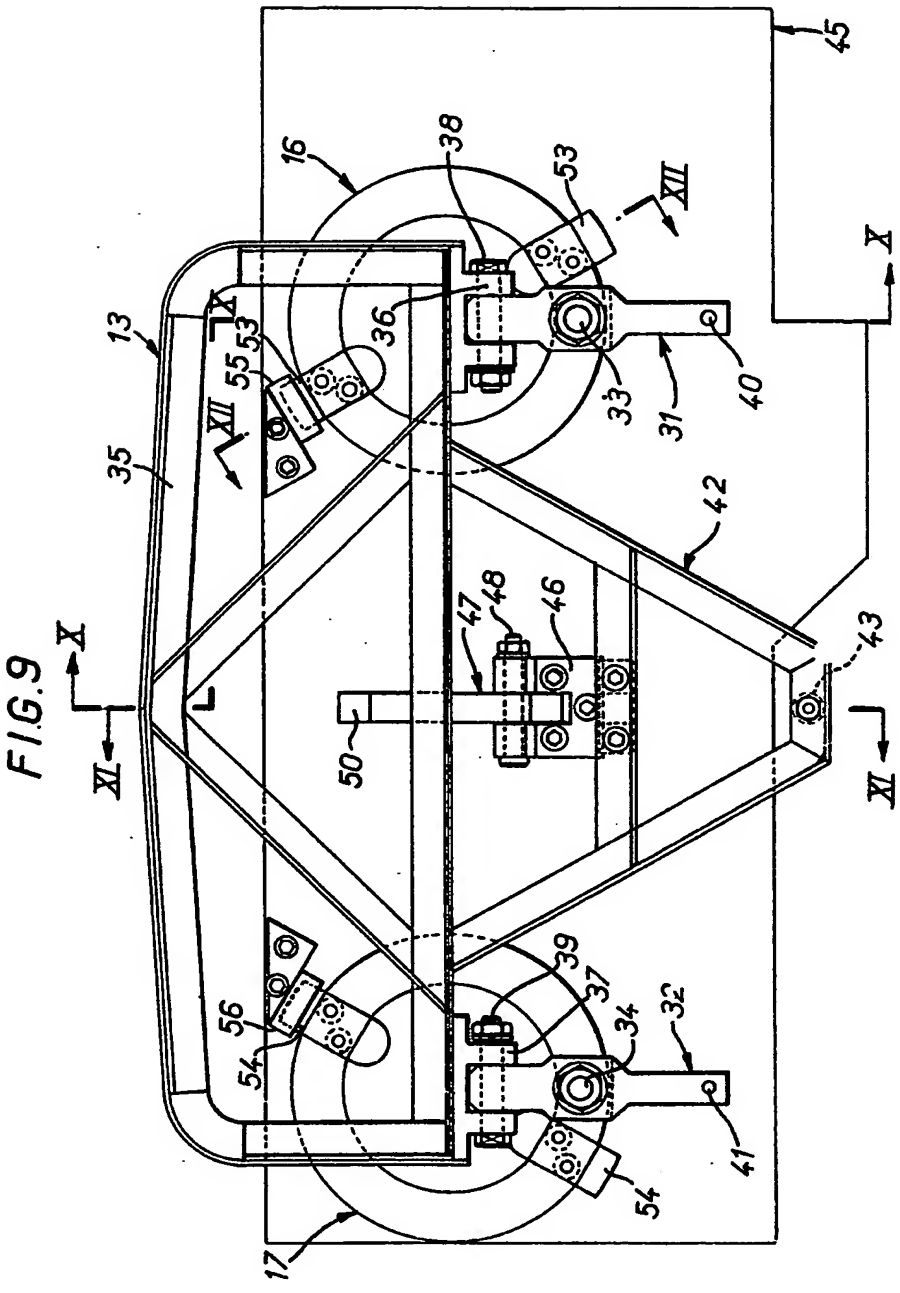


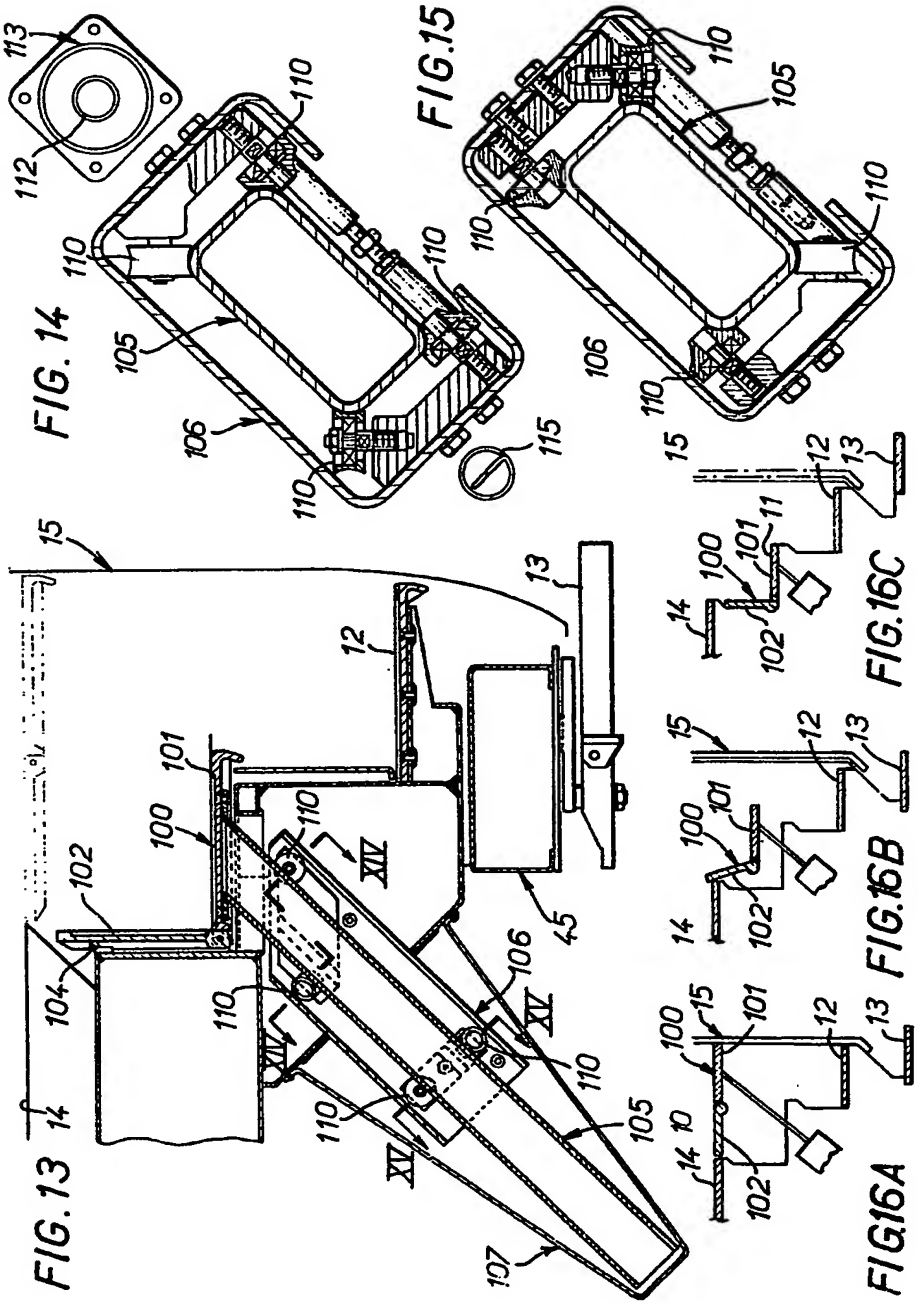
FIG.9

1410 615
8 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

SHEET 6



1 410 615
8 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

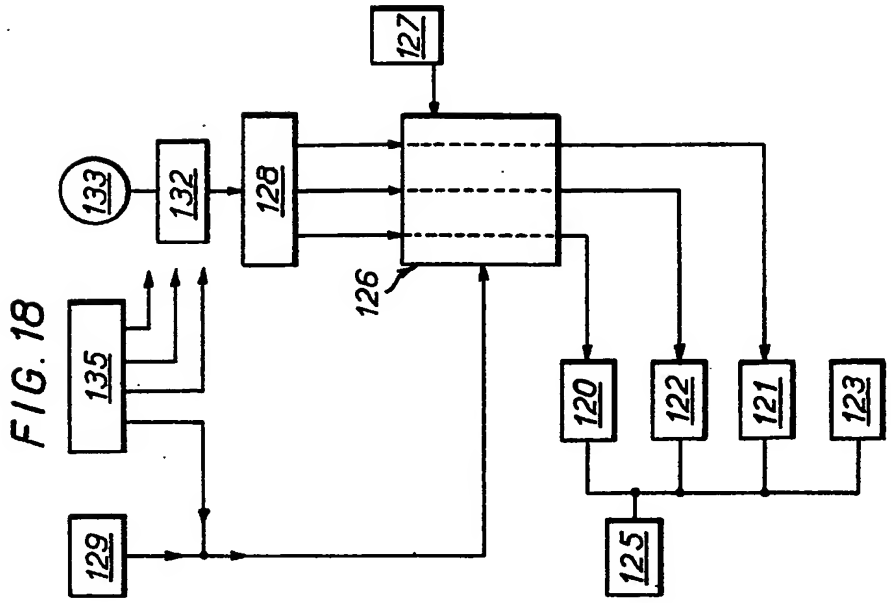


FIG. 18

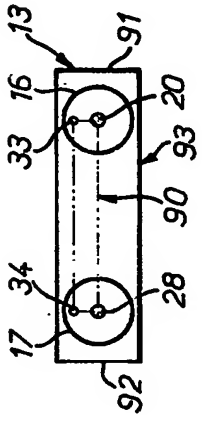


FIG.17A

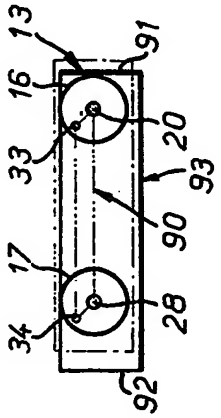


FIG.17B

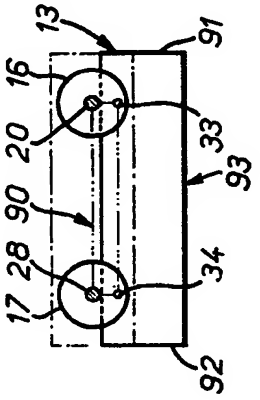


FIG.17C

1 410 615
8 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

SHEET 8

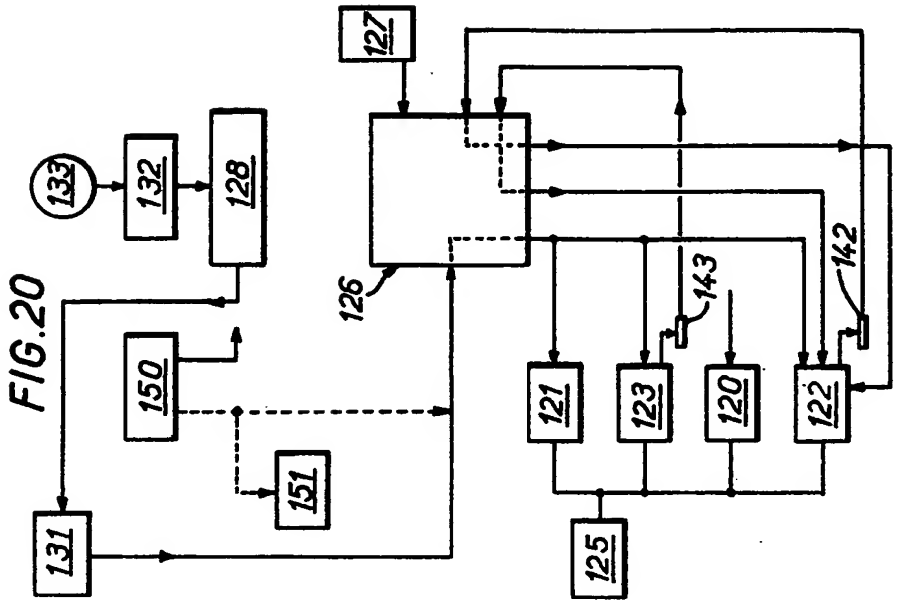


FIG.20

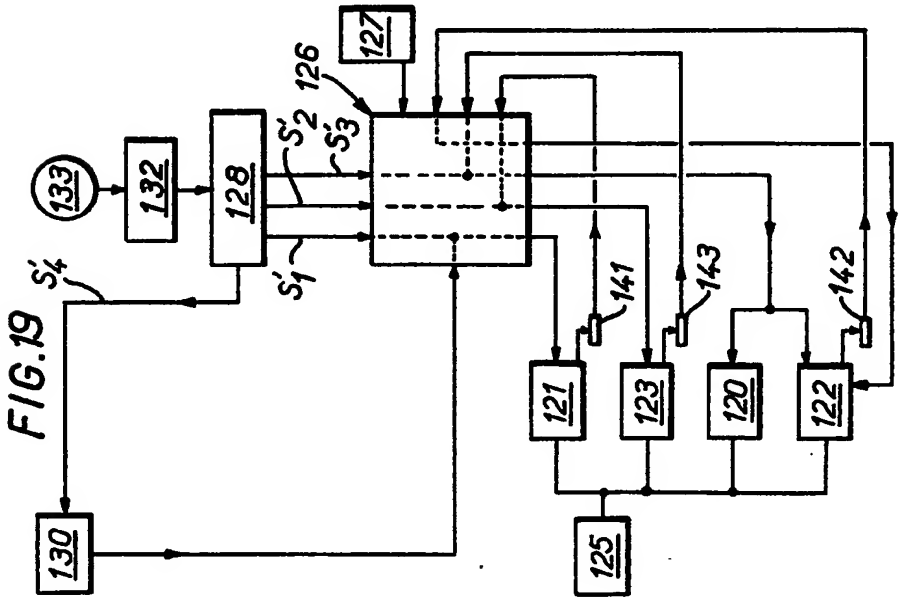


FIG.19

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.